Building Performance Improvement Board

12/21/2022

Learn more at https://www.montgomerycountymd.gov/green/energy/beps.html

Agenda

- **Administrative items**
- **Recap actions from previous meeting**
- **Site EUI Target setting discussion – focus on Zero Net Carbon Compatible target**

Administrative Items

Board Purpose

Role of Building Performance Improvement Board

1. Generally advise the Department on implementation of building energy performance standards.
2. Advise DEP on regulations for implementing the Building Energy Performance Standards
3. Recommend complementary programs or policies, with particular attention to assistance or accommodations for challenged or under-resourced sectors, such as affordable housing, non-profit organizations, and small businesses
4. (Eventually) Help make determinations about unique situations

Team Ground Rules

- Full engagement during meetings
- Listen carefully
- Don’t speak while others are speaking or interrupt others
- Let everyone speak once before you speak twice
- Follow meeting agendas and respect common ground rules
- Review action items at the conclusion of each meeting
- Value other members’ time (e.g., stick to meeting times and agenda topics, avoid off-topic tangents)
- Assume positive intent
- Maintain an open mind to other perspectives than your own
- Maintain mutual respect for one another
- Engage in respectful conflict
- Critique the idea, not the person
- Don’t take yourself too seriously and enjoy our time together

Actions

- Approve meeting notes

New Training Requirement

MONTGOMERY COUNTY BCC ETHICS LAW TRAINING - *NEW AS OF NOVEMBER 2022*

The Training is online, and consists of viewing a 50-minute video, completing an evaluation form, and receiving a certificate by email and uploading the certificate.

- Each individual trainee should electronically save the certificate received by email.

LINK TO UPLOAD TRAINING CERTIFICATE OF COMPLETION for all three training modules.

- Each individual trainee should upload the certificate received by using the form on the BCC webpage. Individuals should complete the online form, which includes a field for the staff liaison's email address. An email is generated to the staff liaison with the certificate attached. Staff liaisons should then track the participation of their BCC members.

Previous Meeting Recap

Recap

- Discussed state BEPS requirements and alignment of County site EUI targets:
  - Requires 20% reduction in net-direct GHGs by 2030 (vs 2025 average buildings of similar average construction)
  - Requires net-zero direct GHGs by 2040
  - To-be-determined site EUI targets
- General agreement on at least “some alignment” with state goals such that County EUI targets put buildings on the path to achieve 2040 net-direct GHG emissions
- Zero Net Carbon Compatible (ZNC) target is most aligned with spurring net-direct GHG reductions
  - Target is set to require both efficiency *and* efficient electrification of most end uses to reach the EUI target

EUI Target Setting:
Focus on ZNC Target

Goals for Discussion

- Focus on *principles* and *methodology* of standard setting
- Apply uniform standard setting methodology to each building group to arrive at site EUI targets…not debating numbers
- DEP to consider advice about methodology in calculating targets
- Extensions/adjustments for under-resourced buildings still a topic that needs discussion

Considerations for Site EUI Target Setting

- **State and local goals/requirements**
  - State requirement for net zero direct GHG emissions by 2040
  - County climate goals (100% reduction in GHGs by 2035)
- **Technical feasibility of meeting the target**
  - Conservation and efficiency strategies
  - Efficient electrification strategies
- **Costs of reaching the target**
  - Up-front replacement costs
  - Ongoing operating costs
  - Available incentives, financing, and resources
- **Available compliance paths**
  - Inclusion of renewable energy allowance
  - Building Performance Improvement Plan option for “economic infeasibility” or other circumstances out of the owner’s control

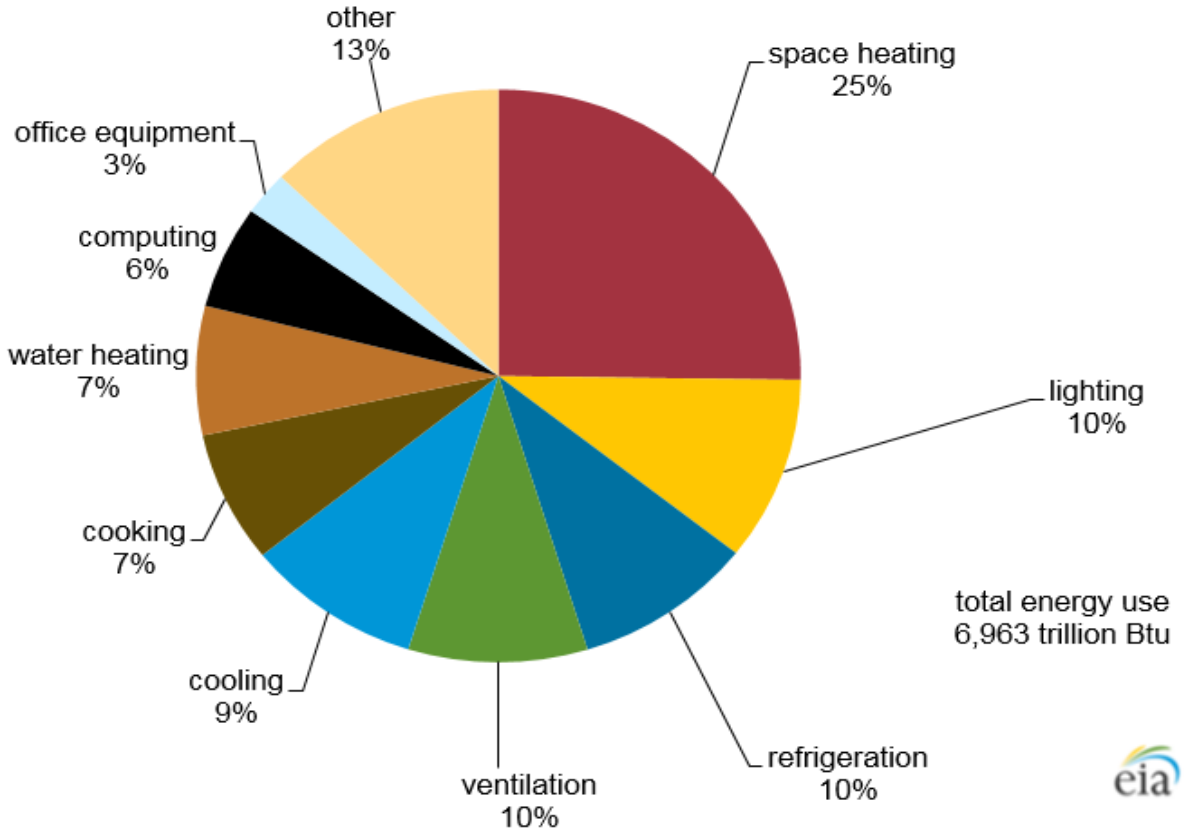
ZNC Target:
Background Info

ZNC Target Overview

- Technically feasible limit on site EUI that models energy efficiency + efficient electrification of end uses.
- EUI is reduced through efficiency AND electrification measures.
- Provides largest on-site (direct) and total carbon reduction, especially as grid decarbonizes.
- Higher up-front costs and potentially longer payback, with more limited options – in many cases electrification is necessary to reach the target.
- Most aligned with state net zero direct emissions goals.

Energy use in buildings and BEPS targets

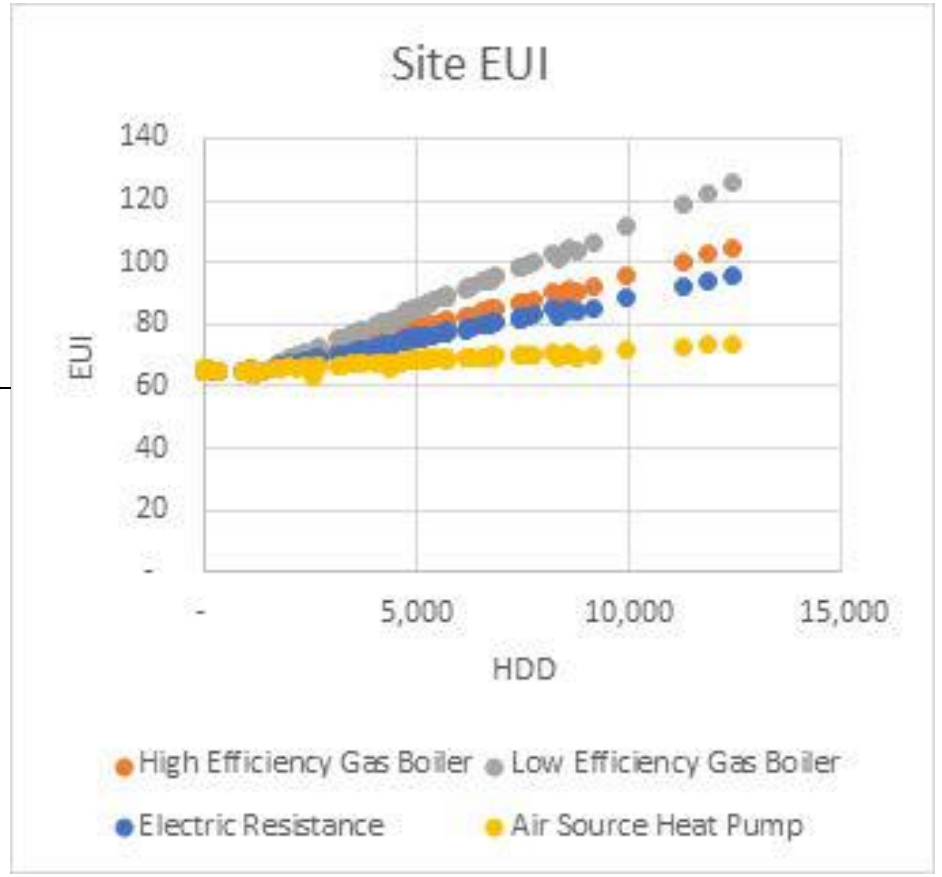
- Some buildings have **on-site combustion systems** that use natural gas (most commonly), fuel oil, propane, steam, etc for heating, domestic hot water heating, and cooking needs
  - **A net direct GHG target focuses only on these end uses (and commercial cooking uses excluded from state req.)**
- Most buildings use **electricity** from the grid for some end uses
  - Lighting, plug loads, cooling (usually)
  - Heating, hot water heating, and cooking can be electric as well
- **A site EUI target looks at whole-building efficiency of both electric + combustion systems**



Source: U.S. Energy Information Administration, 2012 Commercial Buildings Energy Consumption Survey.

Electrification and Site Energy Use Intensity (site EUI)

- Site EUI measures energy use per square foot per year.
- Site EUI favors electrification regardless of the efficiency of the electric technology.
- **Electrification is one of the deepest forms of site energy efficiency because electric equipment operates at higher efficiency than fuel-fired equipment.**
- Setting a low BEPS site EUI target would require buildings to electrify end uses efficiently over time *and* improve electric efficiency.

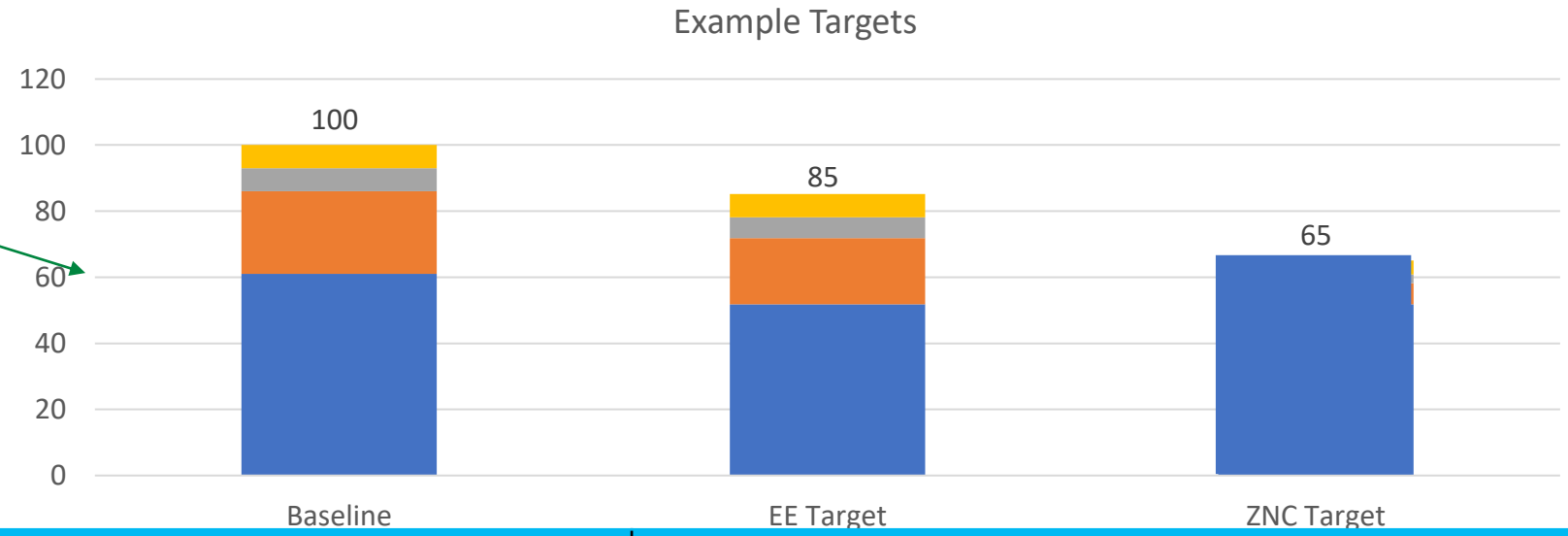


Source: US EPA, Understanding and Choosing Metrics for Building Performance Standards and Zero-Carbon Recognition, May 2021

Site EUI Target Methodology

- We can estimate the typical energy end uses for each building type group
- From there, apply standard reduction targets to different end uses based on what is achievable through energy efficiency (EE target) or energy efficiency + electrification (ZNC target) for each end use to arrive at whole-building site EUI targets

Energy End Use for a Building Group



Energy End Use for a Building Group	Percent reduction from the localized median EUI for EE target	Additional percent reduction starting from the EE target for ZNC target
Electricity	15%	0% (no further change)
Gas Space Heating	20%	68%, all electric (COP* 0.80 → 2.50)
Gas Water Heating	10%	59%, all electric (COP 0.90 → 2.20)
Gas Cooking	0%	39%, all electric (COP 0.45 → 0.74)
Gas Laundry/Other	0%	11%, all electric (COP 0.90 → 1.00)

Zero-Net Carbon Compatible (ZNC) Target

- An EUI level simulating the electrification of all fossil fuel end uses using market-ready technology in an energy efficient building.
- The ZNC targets are a technically feasible limit on building energy performance for each group

Energy End Use for a Building Group	Percent reduction from the localized median EUI for EE target	Additional percent reduction starting from the EE target for ZNC target
Electricity	15%	0% (no further change)
Gas Space Heating	20%	68%, all electric (COP* 0.80 → 2.50)
Gas Water Heating	10%	59%, all electric (COP 0.90 → 2.20)
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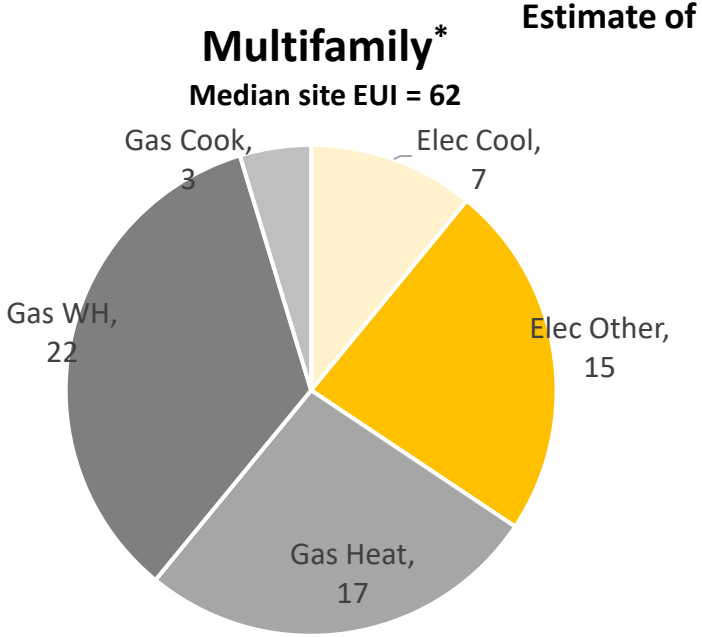
Gas Laundry/Other	0%	11%, all electric (COP 0.90 → 1.00)

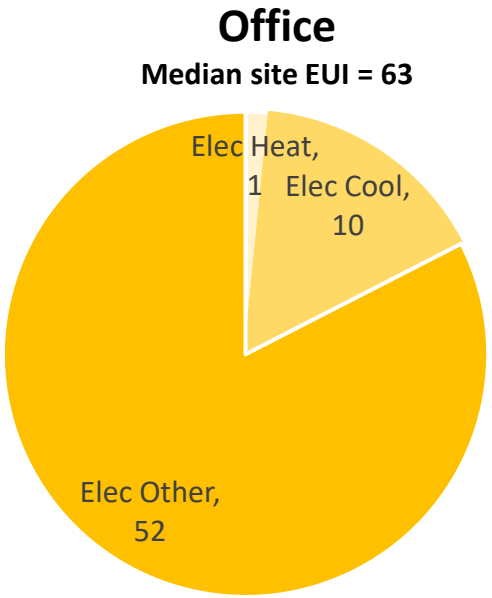
**COP is the Coefficient of Performance of the equipment, defined as energy output (heat) divided by purchased energy input (gas or electricity). A COP of 0.8 is an annual efficiency of 80%. A heat pump can operate at average efficiencies of 250% (COP of 2.50) by extracting heat from the outside air.*

Example Building Types – Achievable Savings

- Different buildings types use energy differently to meet their occupancy needs, and source that energy in different ways
- Some building types are already substantially electric (e.g., offices) – in these cases the EE and ZNC targets are the same (on average, no additional savings potential for electrifying)
- Building types with large gas uses have more potential for reductions in site EUI (e.g., multifamily)

Estimate of Site EUI by end use



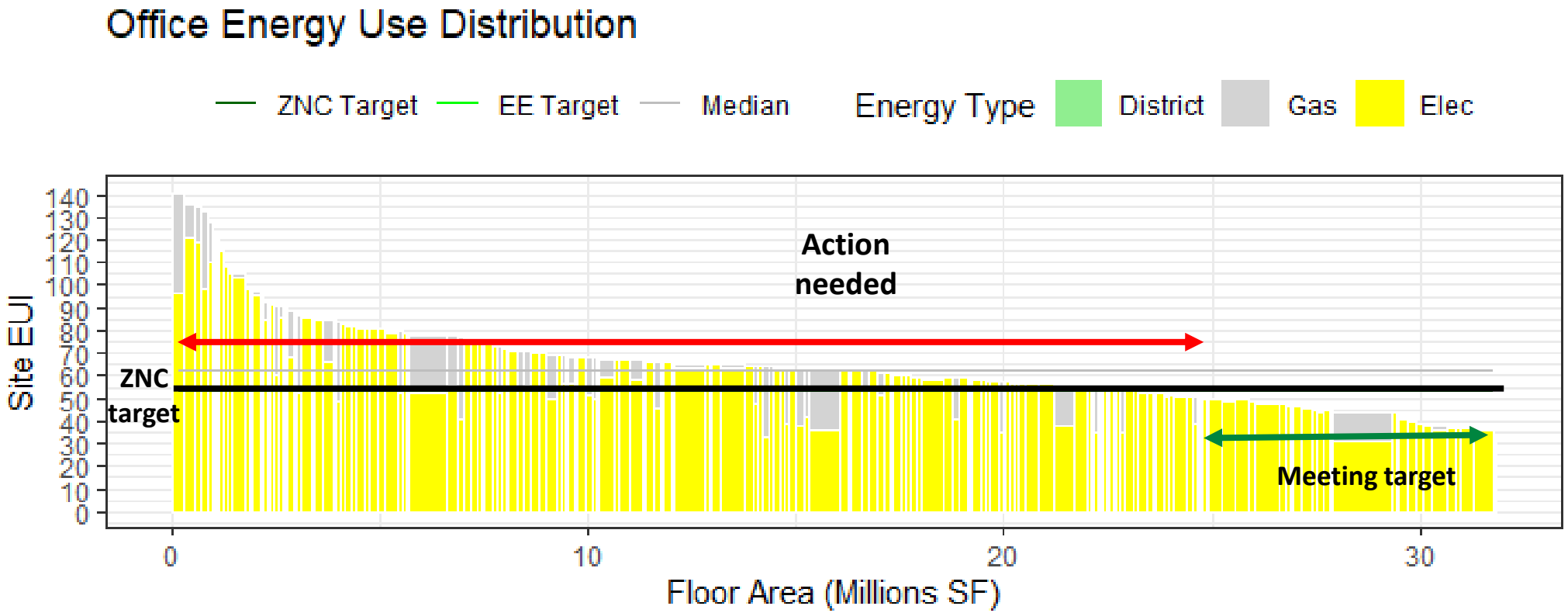


Site EUI	2019 Median	ZNC % reduction from median
Multifamily	62	**44%**
Office	63	**16%**

* MF, Old, Tall typology from DC benchmarking data

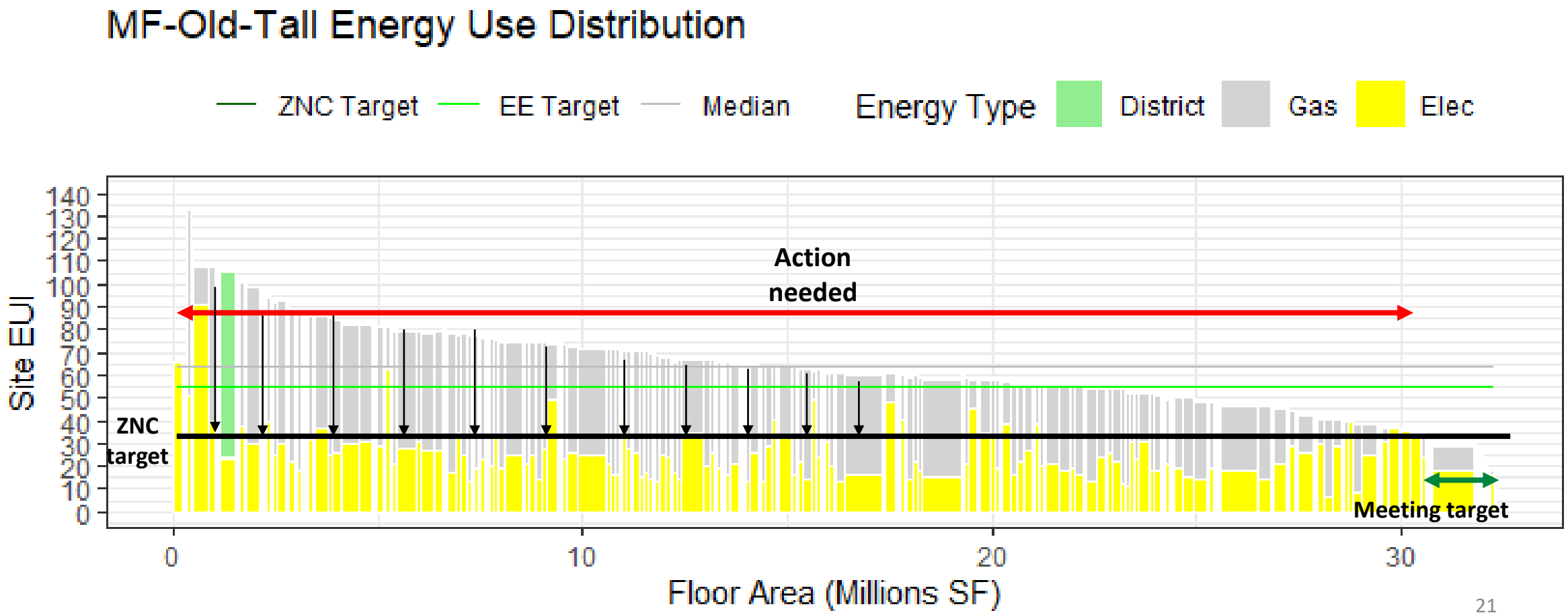
Energy Use & BEPS Targets, Sample Building Typologies

% of Buildings Needing to Reduce Site EUI to Reach Target	Total covered	ZNC
Office	391	**81**%

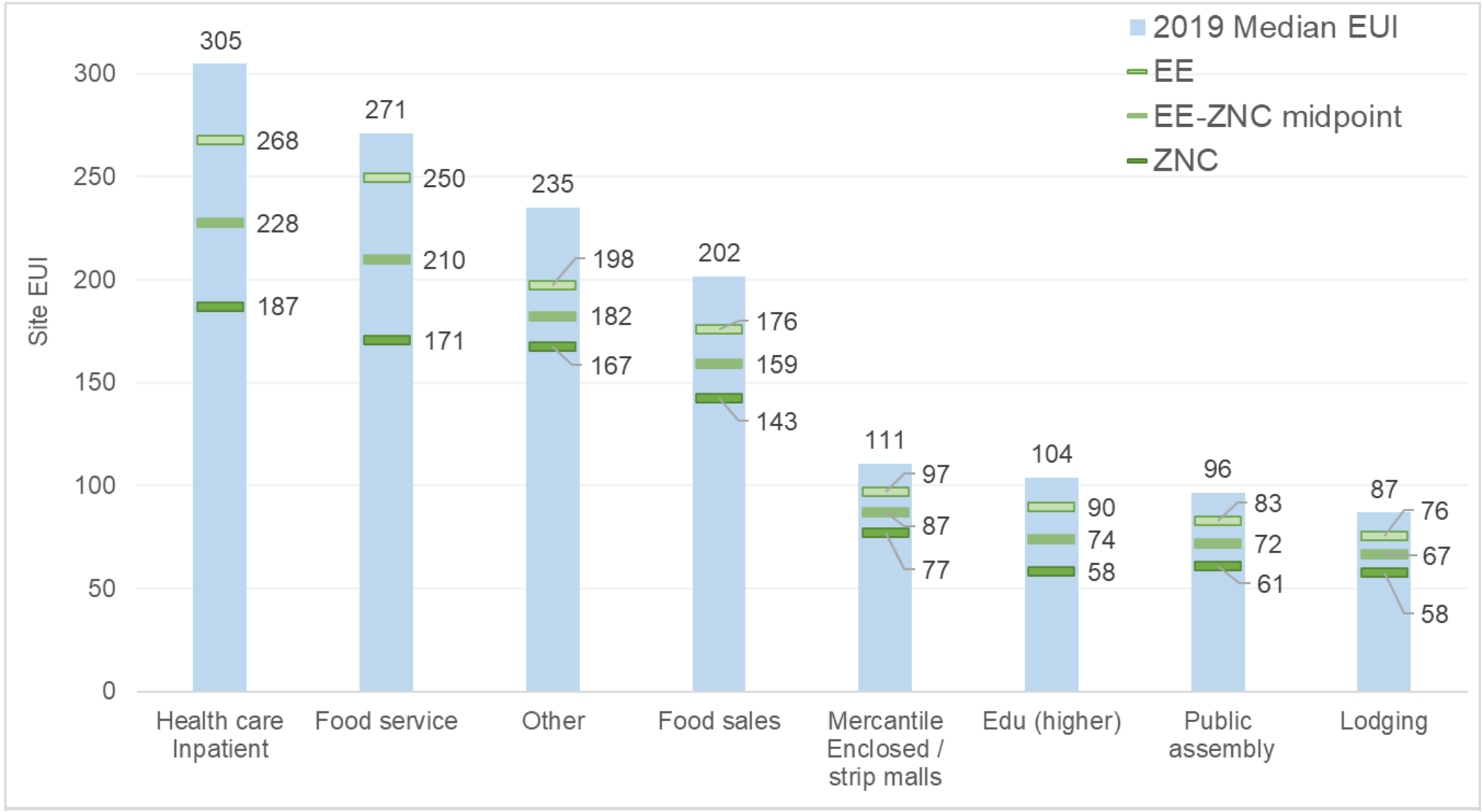


Energy Use & BEPS Targets, Sample Building Typologies

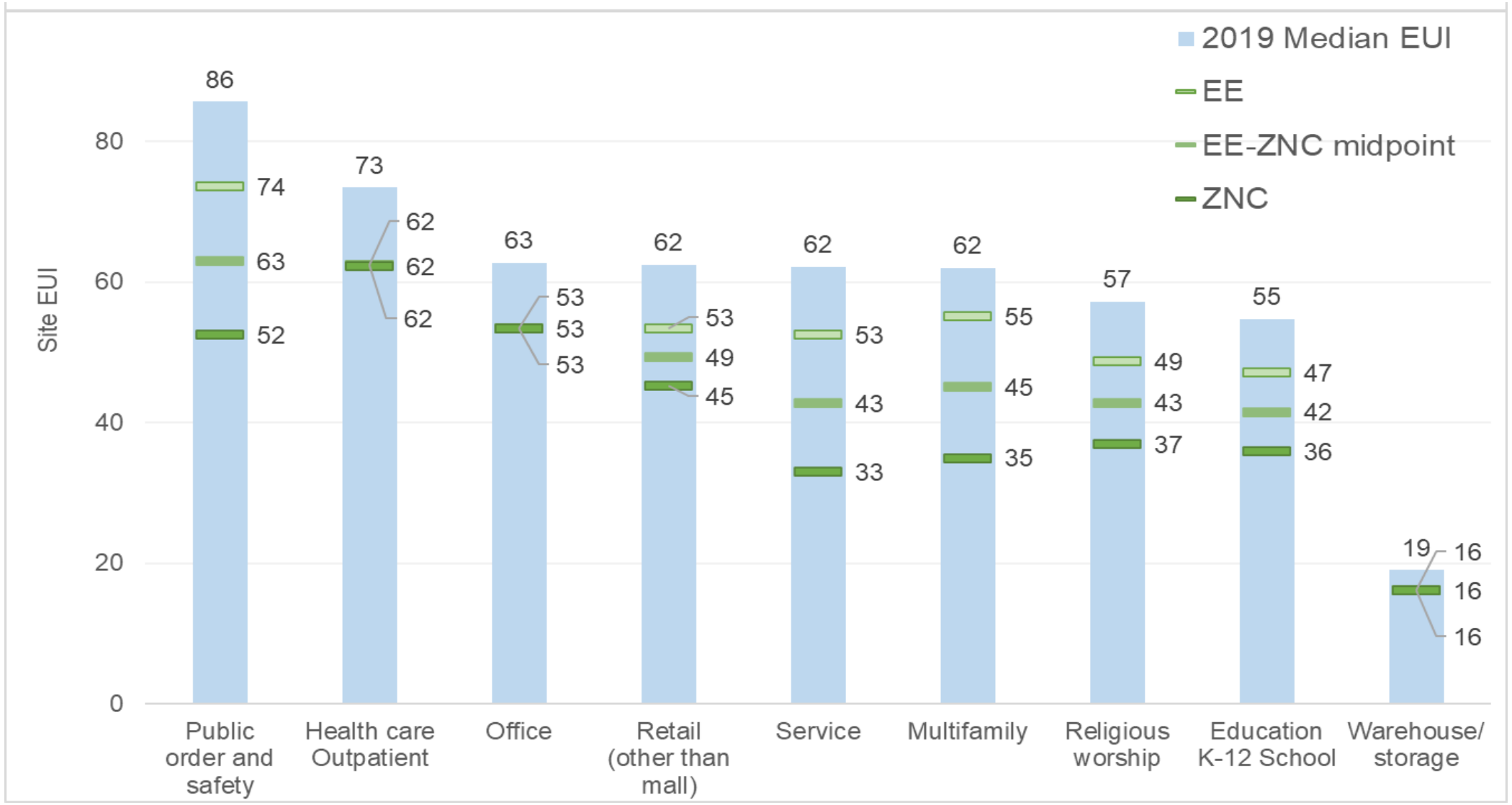
% of Buildings Needing to Reduce Site EUI to Reach Target	Total covered	ZNC
MF-Old-Tall *(built before 1980, 4 stories and up)*	90	**90%**



Site EUI Options from BEPS Technical Report Building Groups (1 of 2)



Site EUI Options from BEPS Technical Report Building Groups (2 of 2)



Impact & Alignment: County-Wide Energy and Emissions Reductions

Selecting an EE target would allow new fossil-fuel equipment to be installed, locking buildings into a long period of fossil fuel use until the next replacement cycle, e.g., 15-20 years.

Selecting a ZNC target, if implemented along with the realization of a 100% carbon-free electricity supply, would result in the deepest emissions reductions.

	EE	EE-ZNC midpoint	ZNC
Reduction in Site EUI vs baseline	23%	28%	35%
Reduction in On-site Fossil Fuel Emissions	46%	66%	86%
Reduction in emissions vs baseline (**NO** change from today's grid)	19%	22%	26%
Reduction in emissions (carbon free electric supply)	87%	92%	97%

Discussion

- Thoughts on ZNC targets?
- Additional questions?
  - Subsequent slides cover technical feasibility, estimated cost impacts, available incentives

ZNC Target:
Technical Feasibility

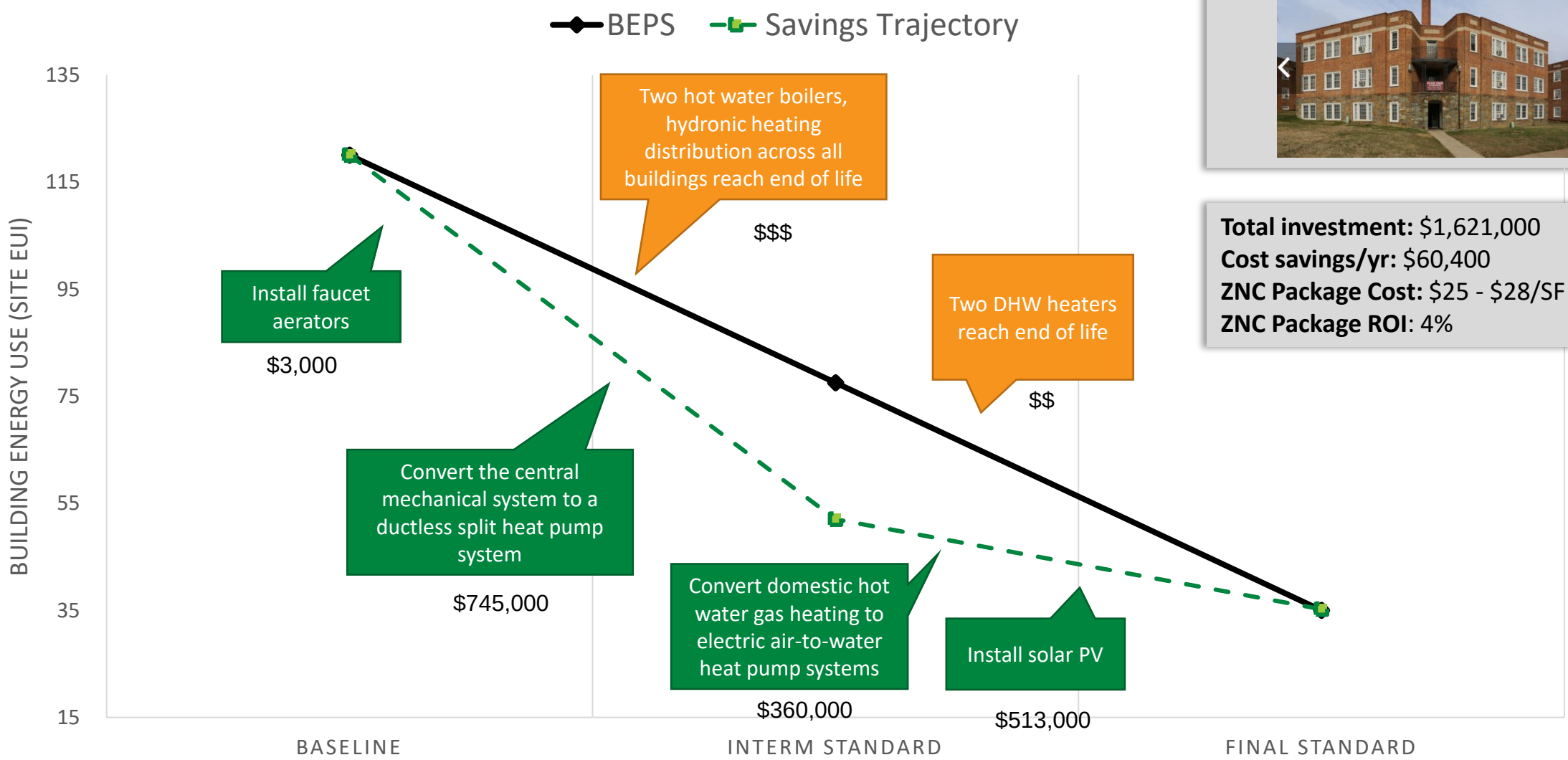
BEPS Technical Report Case Studies

- Case studies looked at 9 buildings in common building types that were above proposed EE and ZNC targets
- Created EEM packages from virtual audits to evaluate technical feasibility and rough, estimated costs to reach targets
- Included:
  - Class A office
  - Mixed-fuel office
  - Older all-electric office
  - New, tall multifamily
  - Old, tall, affordable multifamily
  - Garden style, affordable multifamily
  - Full-service hotel
  - Partial-service hotel
  - Worship

Case Study Example: Garden Style Multifamily, ZNC

Building Information
Square Footage: 50,000 – 75,000 SF
Year Built: 1950 – 1955
2019 Site EUI (kBTU/SF): 120

Total investment: $1,621,000
Cost savings/yr: $60,400
ZNC Package Cost: $25 - $28/SF
ZNC Package ROI: 4%



BEPS Technical Report Case Studies – Common EEMs

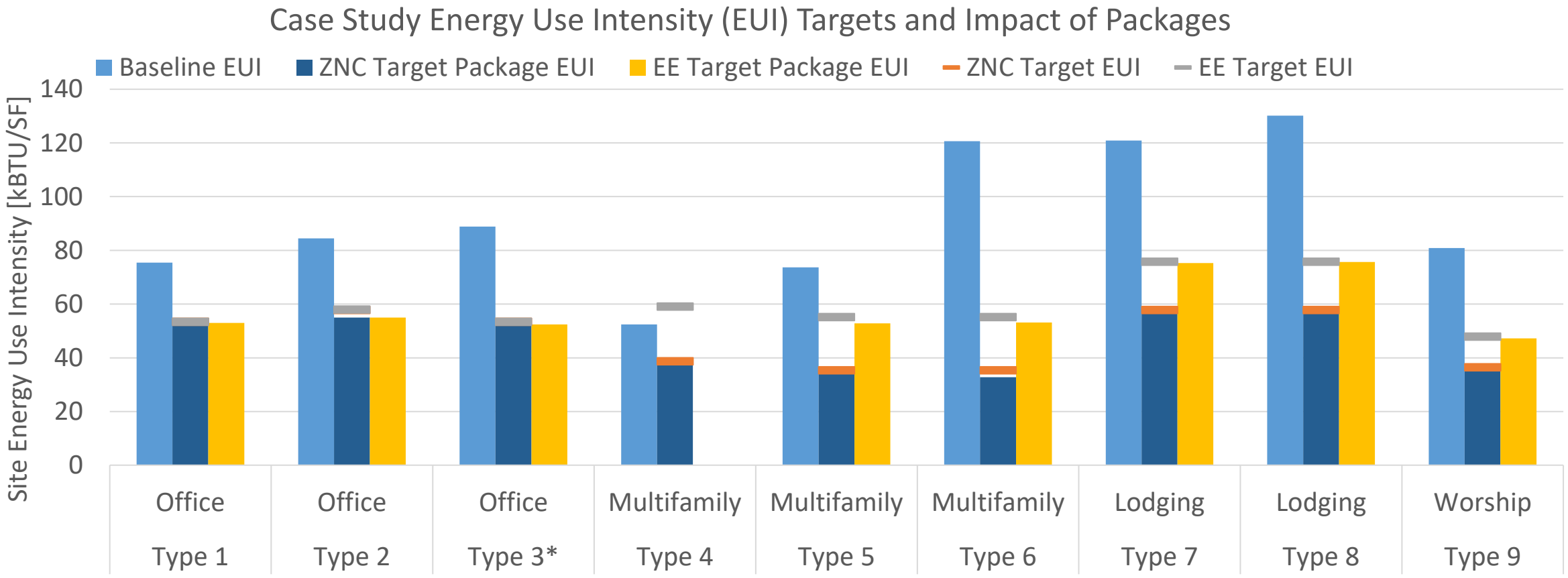
O&M	HVAC Schedule Adjustments	Adjust existing HVAC schedules to align with occupancy
	Retro-commissioning	Retro-commission and implement improvements on central building systems
	Wider Deadbands	Expand deadbands for central mechanical equipment
Controls	Add Programmable Thermostats	Add programmable thermostats to apartments, provide instructions to occupants on use
	Electric Submetering	Install submeters to incentivize tenants to reduce their energy use
	Guest Room Controls	Add automatic guest room controls to limit extra energy usage during unoccupied times
	Plug Load Management	Install smart plug load management tools
Lighting	Daylighting Controls	Install daylighting sensors to turn off lights in perimeter spaces
	Finish LED Conversion	Convert the remaining lighting systems to LED
	Finish LED Conversion	Complete ongoing LED conversion
	Garage LED upgrade	Complete ongoing LED conversion for the parking garage
	Lighting Occupancy Presence Sensors	Install lighting sensors to sense occupants in offices
Water	High-Efficiency Water Aerators	Install high-efficiency aerators in faucets and showers
Solar	Solar PV	Install roof-mounted solar PV
	Solar PV	Install canopied solar PV

BEPS Technical Report Case Studies – Common EEMs

HVAC	Booster Pump VFDs	Install variable frequency drives on domestic water booster pumps
	Central Plant Pump VFDs	Install variable frequency drives on central distribution pumps
	Cooling Tower Fan VFDs	Install cooling tower fan variable frequency drives
	CW Pump VFDs	Install condenser water pump variable frequency drives
	Loop Pump VFDs	Install VFDs on the loop pumps
	Convert to VRF System	Convert the mechanical system to a VRF system
	Install ERV	Install an exhaust recovery ventilation unit
	Pneumatic Conversion to DDC	Convert central plant pneumatics to DDC and calibrate/optimize system
	Recommission Heat Recovery	Recommission existing heat recovery ventilation system
Electrification	DOAS Conversion to Electric	Install a dedicated electric outdoor air system with heat recovery capabilities
	Electrify DHW	Convert domestic hot water gas heating to electric air-to-water heat pump systems
	Electrify Restaurant	Convert gas cooking to electric cooking
	Electrify Space Heating	Convert the central boiler to an air-to-water heat pump
	Electrify Space Heating	Convert the central mechanical system to an air-to-water heat pump system
	Electrify Space Heating	Convert the central mechanical system to a ductless split heat pump system
	Electrify Space Heating	Convert existing HVAC system to an electric heat pump system
	Electrify Space Heating	Convert existing gas heating system to an electric heat pump system
	Electrify Water Heating	Convert existing DHW system to electric DHW
Envelope	General Air Sealing	Air seal gaps in masonry, between window/wall sealing, doors, and other envelope

Impact: Case Study Buildings – Technical Feasibility

- In all case studies, the ZNC target was technically achievable with existing technology and systems through a combination of energy efficiency, electrification, and on-site solar PV
- Targets are technically achievable using today's technology



ZNC Target:
Costs

Costs in BEPS Technical Report

- Total capital cost does not include avoided cost from the replacement of existing equipment
- Cost does not include financial assistance available for energy efficiency retrofits
- Cost savings assume flat rates for natural gas and electricity
  - $0.129 / kWh for electricity
  - $1.228 / therm for natural gas
- Costs estimated for countywide implementation
- Costs estimated in 9 case study buildings which were selected because in most cases they would have significant work to do to reach the EE or ZNC target (so costs tend to be higher than the countywide averages)

Case Study Buildings – Costs/Benefit Terminology

- **Cost per square foot** = total cost of all efficiency measures in the target package over the course of the BEPS compliance period divided by gross floor area
  - Costs = full cost of new system, not incremental cost above standard replacement.
  - Most major in-building equipment (i.e., mechanical equipment) is likely to be replaced prior to 2035. This creates a lower "effective" cost of compliance, but baseline capital costs are highly building dependent. Baseline capital cost outlay, financial incentives, and financing are not included in this report.
- **Savings per square foot** = total **annual** savings from all efficiency measures in the target package divided by gross floor area
- **Simple payback** = total project cost divided by the energy cost savings per year
  - Equates to the number of years until the annual cost savings "pay back" the up-front investment
- **Return on Investment (ROI)** = energy cost savings per year divided by the total cost, converted to a percentage
  - Equates to the percentage return of a particular investment.

Impact: Case Study Buildings – Costs/Benefits

- The ZNC target packages delivered a positive return on investment for all case-study buildings, though with long simple payback
- Costs = full cost of new systems over whole BEPS period, not incremental cost above standard replacement, do not factor in incentives, and do not forecast future utility rates or potential penalties

	ZNC
Cost* per square foot	$11 - $34 ***Average: $25***
Annual savings per square foot	$0.30 - $1.50 ***Average: $0.77***
Simple Payback	19 – 57 years ***Average: 32 years***
Return on Investment	2% – 5% ***Average: 3%***

Impact: County-Wide Estimated Financial Costs and Savings

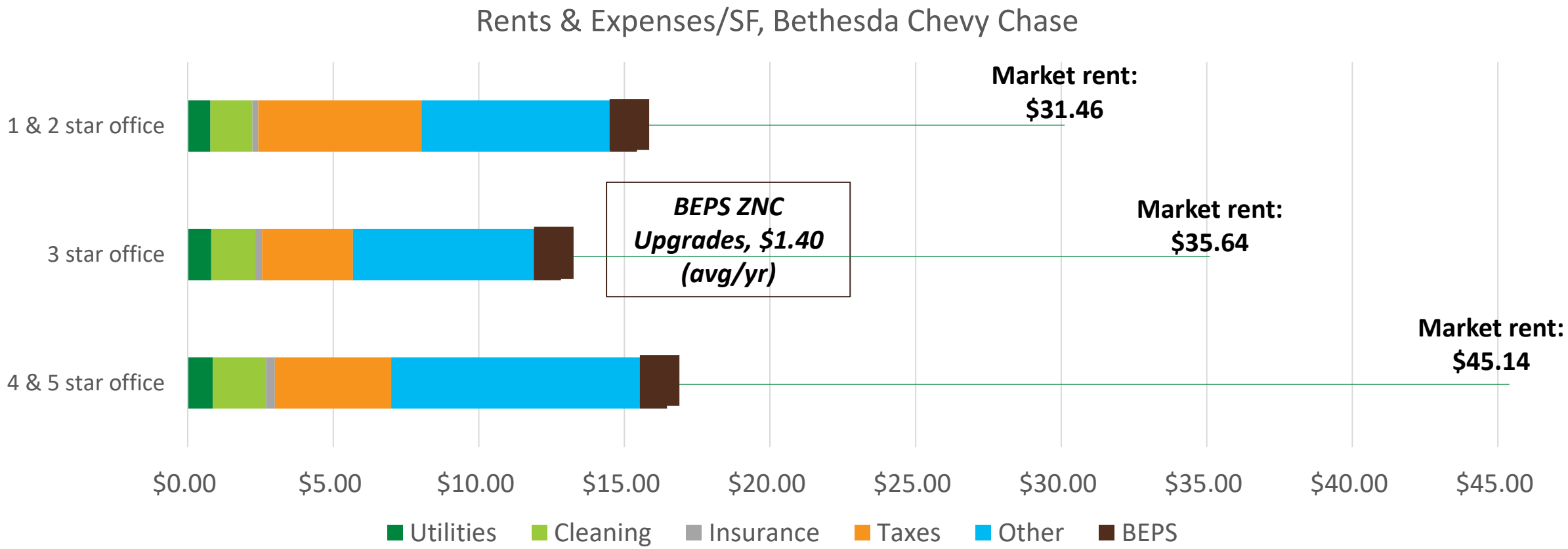
Costs = full cost of new system, not incremental cost above standard replacement.

	No BEPS	ZNC	
Energy Costs (annual, post-BEPS)	$543	$437	*Million*
Energy Cost Savings (annual, post-BEPS vs baseline)	$0	$106	*Million*
% Energy Cost Savings (annual, post-BEPS vs baseline)	0%	19%	*% lower than baseline*
Total BEPS Related Capital Cost* (annual average over 10 years)	$0	$324	*Million*
BEPS Related Capital Cost* / SF / year (annual average over 10 years)	$0	$1.40	*$/SF/year*

Most major in-building equipment (i.e., mechanical equipment) is likely to be replaced prior to 2035. This capital cost can be redirected toward deeper retrofit projects. This creates a lower "effective" cost of compliance, but baseline capital costs are highly building dependent on factors outside of the study. Baseline capital cost outlay, financial incentives, and financing were too building-specific to determine, and thus, are not included in this report.

BEPS Related Capital Costs / SF in Context

- Costar market reports show annual expenses per square foot as well as rental income per square foot
- Report shows total average rental income for Bethesda/Chevy Chase offices: $41.26 per square foot
- Operating expenses per square foot are ~$11-15 per square foot



Existing Incentives

Available Incentives

County Tax Incentives

- New energy performance tax credit for new and existing buildings

EmPOWER MD incentives

- Staff O&M training, building tune ups, rebates

Financing and technical assistance offered by Montgomery County Green Bank and MD Clean Energy Center

MEA programs

- Grants, financing, CHP, EV charging, solar, resiliency hubs

Federal Incentives

- Tax credits/deductions (179-D, ITC, etc)

Property Tax Credits

County Tax incentives

- New energy performance tax credit for new and existing buildings
- Up to 100% deduction in property taxes. If awarded, the property will receive a credit granted against the county taxes owed for two (2) years.
- Two-tiered incentive for measured performance and green building certification in new or existing buildings
    - **1st Tier** – Earn an incentive for a measurable reduction in energy use:
        - *Existing buildings must demonstrate improved energy performance using Portfolio Manager.*
        - *Buildings located in Equity Emphasis Areas receive an additional 10% credit.*
    - **2nd Tier** – Once 1st tier is met, earn additional credit for achieving a certain level of building certification:
        - *Third-party certifications broadened beyond LEED; includes BREEAM, PassiveHouse, Living Building Challenge, other robust, third-party certification systems that strive for net-zero buildings.*

EmPOWER MD Incentives - Electric

- **Prescriptive incentives**
  - Lighting, HVAC, controls, VFDs, commercial kitchen
- **Building Tune Up**
  - Help determine the energy performance of facilities and identify energy saving opportunities by optimizing their existing systems. Primary focus on HVAC and control systems for cost-effective savings opportunities
  - 75% of project cost, capped at $0.20/kWh saved annually and $200,000 per project
- **Monitoring-Based Commissioning**
  - Phase I - installation of automated remote monitoring and diagnostic equipment. 25% of the 18-month monitoring contract cost capped at a maximum of $8,000 and $0.04 per conditioned square foot for the ASHRAE Level II Energy Audit (if provided).
  - Phase II – monitor for at least 6 months and create MBCx Equipment Monitoring Report
  - Phase III - implementation of O&M measures recommended. A one-time incentive of $0.17 per kWh saved annually for all measures that are approved, implemented, and completed.
- **Custom incentives**
  - Measures combined must save a minimum of 25,000 kWh/year of electric energy
  - $0.25/kWh for the first year of projected kWh savings, capped at 50% of total project cost (labor and materials)
- **O&M Training**
  - Incentives covering 80% of the cost of training for contractors and building operation personnel, up to $1,000

EmPOWER MD Incentives - Gas

- **Prescriptive incentives**
  - Heating, hot water heating, boilers, food service, washer/driers, pool heating
- **HVAC Tune Up**
  - Pipe/water heater wrapping and set back
- **Custom incentives**
  - Up to $3.70/therm, capped at 50% of the total costs for the more efficient equipment.
  - Paused as of October 18, 2022 due to limited funding following higher than anticipated program participation

Incentives: Case Study Buildings – Costs/Benefits

- ICF completed an **Addendum to the BEPS Technical Report** that evaluated incentive potential of case study buildings' EEMs
  - Retro-commissioning (RCx) and Building Tune-up project measures tend to benefit the most from incentives.
  - The next most attractive measures tend to be plug load management and lighting retrofit measures. Depending on the baseline condition and building type, incentives often cover 30-40% of the cost to implement.
  - Variable frequency drive retrofit projects are also attractive for incentives, covering around 20-25% of the cost.
  - Many of the HVAC conversion and electrification recommendations tended to benefit the least from incentives as currently designed

Case Study Buildings	ZNC
Cost* per square foot (total *not* annual)	$11 - $34 ***Average: $25***

Case Study	ZNC Incentive Share
1: Class A Office	5% - 6%
2: Older Mixed Fuel Office	6% - 7%
3: Older All-Electric Office	7% - 8%
4: New High-Rise Mixed-Use Multifamily	5% - 6%
5: Old High-Rise Affordable Multifamily	7% - 9%
6: Garden-Style Multifamily	4% - 7%
7: Mid-Sized Hotel w/ Conference Space	8% - 9%
8: Standard Hotel w/ Extra Space	8% - 10%
9: Worship/Education Mixed-Use	4% - 5%
WEIGHTED AVERAGE	7%

EmPOWER MD Incentives – Future?

- PSC EmPOWER MD Future Programming Working Group meeting now to deliberate on what incentives will be included in the 2024-2026 EmPOWER cycle
  - Performance metric for counting savings?
  - Fuel switching?

Montgomery County Green Bank

- **Financing**
  - Commercial Loan for Energy Efficiency and Renewables (CLEER)
    - Funds for commercial and industrial (C&I) property owners, including nonprofits, common ownership community associations, and multifamily properties.
    - 100% financing; Up to 12 years - Can include up to 30% of costs for other energy saving improvements
  - Commercial Property Assessed Clean Energy (C-PACE)
    - 100% upfront, 20-year financing, debt service paid through surcharge on property tax bill
  - Commercial Solar PV Renewable Energy Power Purchase Agreement (CSPPA)

- **Technical Assistance**
  - Providing subsidized energy audits

Federal Tax Credits

- Inflation Reduction Act (IRA) expanded 179-D
  - Starting in 2023, the base deduction rate starts at $0.50/sf for 25% improvement against the building's own pre-retrofit site energy usage intensity and increases incrementally up to $1.00/SF for 50% improvement.
  - A bonus deduction is available for projects meeting prevailing wage and apprenticeship requirements. This bonus deduction starts at $2.50/SF and increases 10 cents for each percentage improvement up to $5.00/SF.
  - Three-year cap, meaning a building can be eligible for the 179D deduction every three years assuming at least one of the systems contributing to energy efficiency has been properly renovated.
  - Now applicable to real estate investment trusts and certain tax-exempt entities who can allocate the deduction to the "designers"

Discussion

- Additional thoughts on ZNC target?
- Thoughts on existing incentive and support programs?

Next Steps

- Extensions and adjustments for under-resourced buildings
- Renewable Energy Allowance
  - May make it easier to reach the County's BEPS without full electrification by providing a "credit" for renewable energy
- Building Performance Improvement Plans
  - Need to determine criteria under which a BPIP will be allowed – "financial infeasibility" and circumstances outside of an owner's control
  - Need to determine implementation requirements – "cost effective" measures

Helpful Links

- Benchmarking and Performance Standards Law
- Benchmarking Website
- BEPS Website
- Building Performance Improvement Board Website (will include agendas, notes, and presentations)
- BEPS Stakeholder workgroup + report – completed before bill was introduced to gather stakeholder input on BEPS policy elements
- BEPS Technical Report – outlines options for site EUI targets by building type group and assesses feasibility and costs in representative case study buildings
    - Presentation of BEPS Technical Report to Council Transportation & Environment Committee
- Allowance for Renewable Energy Technical Report and Recommendations - provides information on determining how a renewable energy allowance should be defined and implemented within BEPS regulations
- On weather and business normalization:
    - EPA technical reference guide on weather normalized energy use
    - EPA's Recommended Metrics and Normalization Methods for Use in State and Local Building Performance Standards document

Helpful Links (continued)

- Maryland Clean Energy Center 10/25 Webinar, Solutions to Achieve Building Energy Performance Standards recording
- Maryland Department of Environment BEPS page

Questions?

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BPIB Webpage
https://www.montgomerycountymd.gov/green/energy/bpib.html

Stay Informed
Check BEPS website for real-time updates:
https://www.montgomerycountymd.gov/green/energy/beps.html

Sign up for Commercial Energy Newsletter

DEPARTMENT OF ENVIRONMENTAL PROTECTION